

**STS-111 ORBITER POST LANDING INSPECTION**  
**Debris Assessment**  
**20 June 2002**

After the 10:58 a.m. local/pacific time landing on 19 June 2002, a post landing inspection of OV-105 Endeavour was conducted at the Edwards Air Force Base on Runway 22 and at the Mate-Demate Facility (MDD). This inspection was performed to identify debris impact damage and, if possible, debris sources.

The Orbiter TPS sustained a total of 79 hits of which 26 had a major dimension of one-inch or larger. This total does not include the numerous hits on the base heat shield attributed to SSME vibration/acoustics and exhaust plume re-circulation.

The following table lists the STS-111 Orbiter damage hits by area:

	HITS $\geq$ 1-inch	TOTAL HITS
Lower Surface	21	47
Upper Surface	1	6
Window Area	3	19
Right Side	0	4
Left Side	1	3
Right OMS Pod	0	0
Left OMS Pod	0	0
TOTALS	26	79

The Orbiter lower surface sustained 47 total hits, of which 21 had a major dimension of one inch or larger. Both of these numbers are within family. A total of 19 hits occurred on the lower surface between the nose landing gear and the main landing gears, with 8 of these hits having a major dimension of one inch or greater. Nine of the 19 damage sites between the landing gears occurred on the right-hand wing glove.

The largest hit on the lower surface measured 3" x 1/2" x 3/8" and was located to the left of the centerline between the main landing gear wheel wells. The second largest hit on the lower surface measured 3" x 1/4" x 3/8" and was located aft of the nose landing gear door, at approximately the same position to the left of the centerline. Both of these hits had relatively large length to width ratios. The similarity of a) the outboard locations of these two hits, and b) the large length to width ratio suggests they may be from the same source.

A total of 14 of the lower surface hits were located in the vicinity of the LH2 umbilical door. Most of these damage sites were caused by pieces of the umbilical purge barrier flailing in the airstream and impacting the TPS tiles before detaching.

A triangular-shaped tile corner ( measuring approximately 2 1/2" by 2 1/2") was missing. The location of the missing tile piece was the inboard end of the right hand inboard

elevon, approximately one third of the elevon chord length downstream of the leading edge.

Damage sites on the window perimeter tiles were less than usual in quantity. There were a total of 19 hits on the window perimeter tiles with 3 having dimensions greater than one inch. Damage to the window perimeter tiles on the forward facing windows is attributed to impact by forward RCS paper covers with RTV adhesive on the back.

Moderate hazing was noted on the upper portion of windows 2, 3, 4 and 5. In addition to hazing, streaks were observed on windows 3 and 4. The streaks may be the result of impacts by RTV adhesive used on the forward RCS paper covers.

The main landing gear tires were reported to be in typical condition for landing on a concrete runway. The main landing gear inboard tires both had damage on the second tread from the inboard side.

ET/Orbiter separation devices EO-1, EO-2, and EO-3 were reported to have functioned normally. No ordnance fragments were found on the runway beneath the umbilicals. Several of the EO-2 fitting retainer clips were missing. The EO-2 and EO-3 pyro shutters were fully closed.

There was less than usual tile damage on the Orbiter base heat shield. The SSME Dome Heat Shield closeout blankets were in good overall condition. Slight fraying was observed on the SSME #1 blanket at the 6 o'clock position. Two large damage sites (approximately 3-inches by 3-inches) on the body flap upper surface tiles adjacent to the body flap stub, appear to be failed repairs.

A post landing walk-down of the runway was performed by the rollout measurement team and no flight hardware was found. All components of the drag chute were recovered and appeared to have functioned normally. Both reefing and line cutter pyrotechnic devices were expended.

In summary, both the total number of Orbiter TPS debris hits and the number of hits one-inch or larger were well within established family. The potential identification of debris damage sources for mission STS-111 will be based on the laboratory analysis of Orbiter post landing microchemical samples, inspection of the recovered SRB components, film analysis, and aerodynamic debris particle trajectory analysis. The results of these analyses will be documented in the STS-111 Debris/Ice/TPS Assessment and Integrated Photographic Analysis Report.

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